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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/929,944	08/15/2001	Yoon Kim	33542-2007	1634

7590 06/04/2004

BAKER & McKENZIE
101 West Broadway, 12th Floor
San Diego, CA 92101

EXAMINER	
WOZNIAK, JAMES S	
ART UNIT	**PAPER NUMBER**
2655	4

DATE MAILED: 06/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/929,944	KIM, YOON
	Examiner	Art Unit
	James S. Wozniak	2655

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 August 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 August 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Detailed Action

Priority

1. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Taiwan on 8/25/2000. It is noted, however, that applicant has not filed a certified copy of the foreign application as required by 35 U.S.C. 119(b).

Claim Objections

1. **Claim 18** is objected to because of the following informalities: the phrase "computing the inverse discrete Fourier transform (DFT) said modeled mel-frequency vocal-tract spectrum" should be corrected to read --computing the inverse discrete Fourier transform (DFT) *of* said modeled mel-frequency vocal-tract spectrum--.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. **Claims 1-3 and 13-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakatoh et al *(U.S. Patent: 6,311,153)*.

With respect to **Claims 1 and 19**, Nakatoh discloses:

A speech recognition system and method comprising:

Linear prediction (LP) signal processing means, coupled to said microphone means, for processing the electronic signals to generate LP parametric representations of the electronic signals (*calculation of a linear predictor of an input speech signal, Col. 9, Lines 48-55)*;

Mel-frequency linear prediction (MFLP) generating means, coupled to said LP signal processing means, for mel-frequency warping said LP parametric representations to generate MFLP parametric representations of the electronic signals *(calculation of Mel-LPC coefficients from linear prediction coefficients, Col. 11, Lines 28-49)*;

In this embodiment of the invention, Nakatoh does not teach a speech recognizer using Mel-LPC coefficients, however in another embodiment Nakatoh discloses:

Word comparison means coupled to the MFLP means, for comparing said MFLP parametric representations of the electronic signals to parametric representation of words in a database *(speech recognizer capable of comparing Mel-LPC features to stored recognition models for word or phoneme recognition, Col. 15, Lines 55-63)*.

It would have been obvious to one of ordinary skill in the art, at the time of invention, to utilize the Mel-frequency coefficients calculated in the first embodiment with the speech recognizer of the second embodiment taught by Nakatoh in order to utilize the Mel- to provide high recognition accuracy while conserving bandwidth in a well-known and practical network-based speech recognition application by only coding perceptible speech features using the Mel-

frequency scale. Also, the examiner takes official notice that it is well known in the art to use a microphone for speech input as a means of receiving a speech signal as an electronic signal to be processed and store recognition models using parametric representatives of said signals in a database, as a means of performing automatic speech recognition.

With respect to **Claim 2**, Nakatoh further discloses:

The speech recognition system, wherein the mel-frequency linear prediction (MFLP) generating means comprises:

Non-uniform discrete Fourier transform (NDFT) generator means for generating the NDFT of said LP parametric representations of the electronic signals *(generating a Fourier transform to obtain mel-frequency coefficients, Col. 11, Lines 28-49, that utilizes a bark frequency scale to account for human auditory characteristics, Col. 10, Lines 8-47)*;

Warper means, coupled to the NDFT generator means, for mel-frequency warping said NDFT (calculating Mel-LPC coefficients from linear prediction coefficients, *Col. 11, Lines 28-49. Since Mel-LPC coefficients are warped LP coefficients, the process of Mel-LPC coefficient generation functions as a warper means.)*;

Smoothing means, coupled to the warper means, for smoothing said mel-frequency warped NDFT (spectrum flattening of a converted Mel-frequency coefficient, Col. 12, Line 66-Col. 13, Line 5 and envelope calculation unit, Fig. 6, Element 22); and

In the present embodiment of the invention, Nakatoh does not teach cepstral parameter conversion means, however in another embodiment Nakatoh discloses:

Cepstral parameter converter means, coupled to the smoothing means, for converting said LP parametric representations of the electronic signals to cepstral parameters *(cepstrum coefficient calculation unit, Col. 15, Lines 55-58, and Fig. 7, Element 8)*.

It would have been obvious to one of ordinary skill in the art, at the time of invention, to implement the cepstrum coefficient calculation unit of the second embodiment in the Mel-LPC feature generation system, both taught by Nakatoh in order to further utilize the calculated coefficients in a speech recognition system as a convenient means of model comparison for recognition. Also, it would have been obvious to one of ordinary skill in the art, at the time of invention, to specifically use the well-known DFT for the FT taught by Nakatoh since a DFT is an efficient Fourier transform commonly used with digital speech signals.

With respect to **Claim 3**, Nakatoh recites:

The speech recognition system, wherein the smoothing means utilizes a low-order all-pole LP generator (all-pass filter used to generate predictive coefficients, Col. 12, Lines 55-65, used in an envelope calculation unit, Fig. 6, Element 22).

Also, it would have been obvious to one of ordinary skill in the art, at the time of invention, to specifically use a low order all-pass filter in order to generate only those parameters that would describe an audible portion of a speech spectrum according to the mel-frequency scale in order to improve coding efficiency.

With respect to **Claim 13**, Nakatoh discloses:

A method for modifying the linear prediction (LP) vocal-tract spectrum comprising the steps of:

Mel-frequency warping the LP vocal-tract spectrum to generate a mel-frequency warped LP vocal-tract spectrum *(calculation of Mel-LPC coefficients from linear prediction coefficients, Col. 11, Lines 28-49)*;

Performing linear prediction on said modeled mel-frequency warped LP vocal-tract spectrum to generate an LP mel-frequency warped LP vocal-tract spectrum *(generation of a frequency spectrum using linear prediction, Col. 12, Line 45- Col. 13, Line 5)*.

Nakatoh does not specifically disclose modeling a Mel-frequency spectrum utilizing a predetermined number of peaks, however, it would have been obvious to one of ordinary skill in the art, at the time of invention, to model a spectrum using a predetermined number of peaks because a certain number of formants are needed and sufficient to represent spectral envelope peaks and thus provide efficient spectrum representation.

With respect to **Claim 14**, Nakatoh recites:

The LP warping method, wherein step (a) comprises the steps of:

Calculating the discrete-time Fourier transform (DTFT) of the finite impulse response LP parameters *(generating a Fourier transform, Col. 11, Lines 28-49, that utilizes a bark frequency scale to account for human auditory characteristics, Col. 10, Lines 8-47)*;

Utilizing a non-uniform grid for said DTFT of the LP vocal-tract spectrum to generate a non-uniform discrete Fourier transform (NDFT) (*bark frequency scale to account for human auditory characteristics, Col. 10, Lines 8-47, utilized in a FT, Col. 11, Lines 28-49)*; and

Oversampling a Mel filterbank to generate a warped grid for said NDFT of the finite impulse response LP parameters *(warping parameters generated by expanding specific frequency bands, Col. 10, Lines 4-18)*

Nakatoh does not specifically suggest taking a predetermined number of LP parameter samples, however, it would have been obvious to one of ordinary skill in the art, at the time of invention, to take a predetermined number of LP parameter samples, since a specific number of samples would be required to clearly represent a speech signal and thus provide a sufficient representation of a speech envelope spectrum. Also, it would have been obvious to one of ordinary skill in the art, at the time of invention, to specifically use the well-known DFT for the FT taught by Nakatoh since a DFT is an efficient Fourier transform commonly used with digital speech signals.

With respect to **Claim 15**, Nakatoh recites:

. The LP warping method, wherein the non-uniform grid of step (c) is substantially similar to the Mel frequency scale *(employing a mel-frequency scale in determining a FT for Mel-frequency LP coefficient warping, Col. 10, Lines 33-35).*

With respect to **Claim 16**, Nakatoh teaches the Mel-LPC feature generation system utilizing a non-uniform FT. Nakatoh does not specifically suggest a linear oversampling from 0 to 1000 Hz and equal space sampling at octaves greater than 1000 Hz; however, it would have been obvious to one of ordinary skill in the art, at the time of invention, to oversample lower frequencies as taught by Nakatoh and applied to Claim 14 at the specific range deemed to be the low frequency range of the present invention, 0 to 1000 Hz, for greater resolution at lower frequencies and sample octaves above 1000Hz, the determined high frequency range as taught by Nakatoh and applied to Claim 14, at a single and reduced sampling frequency where a higher resolution is not necessary to improve encoding efficiency.

With respect to **Claim 17**, Nakatoh discloses the Mel-LPC feature generation system, as applied to Claim 13. Nakatoh does not specifically teach that the number of peaks used for modeling a spectrum is two, however it would have been obvious to one of ordinary skill in the art, at the time of invention, to utilize two largest formant peaks in spectrum envelope modeling, to simplify the processing.

With respect to **Claim 18**, Nakatoh discloses:

The LP warping method, wherein said step (c) comprises the steps of:

Computing the inverse discrete Fourier transform (DFT) of the modeled mel-frequency warped LP vocal-tract spectrum *(subjecting a mel-transformed power spectrum to an inverse-DFT, Col. 15, Lines 10-12)*;

Generating a predetermined number of samples of an autocorrelation sequence of said modeled mel-frequency warped LP vocal-tract spectrum *(generating samples from an autocorrelation function with a warped frequency axis, Col. 15, Lines 13-18)*; and

Performing linear prediction to generate a plurality of LP parameters from the modeled mel-frequency warped LP vocal-tract spectrum *(generation of a spectrum envelope, Col. 15, Lines 13-18, consisting LP parameters, thus it would have been obvious to one of ordinary skill in the art at the time of invention, to further perform linear prediction to extract the LP parameters from the spectrum for use in speech recognition or coding applications)*.

Also, it would have been obvious to one of ordinary skill in the art, at the time of invention, to utilize a predetermined number of samples of an autocorrelation sequence because a certain number samples are sufficient to provide efficient spectrum representation.

4. **Claims 4-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakatoh et al in view of Tran *(U.S. Patent: 6,070,140)*.

With respect to **Claim 4**, Nakatoh teaches the Mel-LPC feature generation system capable of being utilized for speech recognition, as applied to Claim 1. Nakatoh does not teach the use of a specific DTW recognizer, however Tran discloses:

The speech recognition system, wherein the word comparison means is a dynamic time warper speech recognition system *(speech recognition using a DTW model, Col. 18, Line 61-Col. 19, Line 10, and Fig. 19, Element 232)*.

Nakatoh and Tran are analogous art because they are from a similar field of endeavor in speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the speech recognizer utilizing dynamic time warping as taught by Tran with the Mel-LPC feature generation system capable of being utilized for speech recognition as taught by Nakatoh to further improve speech recognition accuracy by utilizing DTW models to account for variations in utterance lengths due to different speaker pronunciations. Therefore, it would have been obvious to combine Tran with Nakatoh for the benefit of obtaining a more robust speech recognition system, utilizing Mel-LPC features, that is compatible with multiple speakers through the use of DTW models, to obtain the invention as specified in Claim 4.

With respect to **Claim 5**, Nakatoh teaches the Mel-LPC feature generation system capable of being utilized for speech recognition, as applied to Claim 1. Nakatoh does not teach the use of a specific speech recognizer utilizing HMMs, however Tran discloses:

The speech recognition system, wherein the word comparison means is a hidden Markov model speech recognition system *(speech recognizer using HMMs, Col. 18, Lines 40-42, Fig. 19, Element 230)*.

Nakatoh and Tran are analogous art because they are from a similar field of endeavor in speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the speech recognizer utilizing HMMs as taught by Tran with the Mel-LPC feature generation system capable of being utilized for speech recognition as taught by Nakatoh to increase the Mel-LPC generation system usability by implementing the generated Mel-LPC features taught by Nakatoh in a well-known and readily-available HMM speech recognizer. Therefore, it would have been obvious to combine Tran with Nakatoh for the benefit of obtaining a more compatible speech recognition system, utilizing Mel-LPC features in recognizing speech through HMM comparison, to obtain the invention as specified in Claim 4.

With respect to **Claim 6**, Nakatoh teaches the Mel-LPC feature generation system capable of being utilized for speech recognition, as applied to Claim 1. Nakatoh does not teach the use of a neural network speech recognizer, however Tran discloses:

The speech recognition system, wherein the word comparison means is a neural network speech recognition system *(neural network speech recognizer, Col. 22, Lines 24-39, and Fig. 24)*.

Nakatoh and Tran are analogous art because they are from a similar field of endeavor in speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the neural network speech recognizer as taught by Tran with the Mel-LPC feature generation system capable of being utilized for speech recognition as taught

by Nakatoh to efficiently improve speech recognition models through the use of a neural network training algorithm. Therefore, it would have been obvious to combine Tran with Nakatoh for the benefit of obtaining a speech recognition system, utilizing Mel-LPC features, capable of providing more efficient speech recognition adaptation processing through the use of a neural network speech recognizer, to obtain the invention as specified in Claim 6.

5. **Claims 7-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakatoh et al in view of Rahim et al *(U.S. Patent: 5,806,022)*.

With respect to **Claim 7**, Nakatoh discloses:

A speech recognition system for recognizing a speech signal, comprising:

A pre-emphasizer for spectrally flattening the speech signal *(flattening the input audio signal, Col. 4, Line 56)*;

A frame blocker, coupled to the pre-emphasizer, for frame blocking the speech signal *(audio signal frames, Col. 4, Line 56)*;

A pre-warp LP generator, coupled to the windower, to generating a plurality of pre-warp LP parameters (*calculation of a linear predictor of an input speech signal, Col. 9, Lines 48-55)*;

A mel-NDFT warper, coupled to said pre-warp LP generator, for utilizing a non-uniform discrete Fourier transform (NDFT) to warp said pre-warp LP parameters on a mel scale to generate a plurality of mel scale-warped LP parameters *(generating a Fourier transform to obtain mel-frequency coefficients, Col. 11, Lines 28-49, that utilizes a bark frequency scale to account for human auditory characteristics, Col. 10, Lines 8-47)*;

A power spectrum generator, coupled to the mel-NDFT warper, for generating a warped vocal-tract power spectrum from said Mel scale-warped LP parameters *(obtaining a warped power spectrum, Col. 15, Lines 7-9)*;

An IDFT generator, coupled to the power spectrum generator, for generating an inverse discrete Fourier transform of the warped vocal-tract power spectrum *(inverse-DFT of a power spectrum, Col. 15, Lines 10-12)*;

A post-warp LP generator, coupled to said IDFT generator, for generating a plurality of post-warp LP parameters *(generation of a spectrum envelope, Col. 15, Lines 13-18, consisting LP parameters, thus it would have been obvious to one of ordinary skill in the art at the time of invention, to further perform linear prediction to extract the LP parameters from the spectrum for use in speech recognition or coding applications)*;

Additionally, Nakatoh, second embodiment, discloses:

A cepstrum converter, coupled to the post-warp LP generator, for converting said post-warp LP parameters to a plurality of MFLP cepstral coefficients *(calculating cepstral coefficients from Mel-LPC coefficients, Col. 15, Lines 55-58)*.

It would have been obvious to one of ordinary skill in the art, at the time of invention, to implement the cepstrum coefficient calculation unit of the second embodiment in the Mel-LPC feature generation system, both taught by Nakatoh in order to further utilize the calculated coefficients in a speech recognition system as a convenient means of model comparison for recognition.

Nakatoh does not specifically disclose a frame windower, however Rahim recites:

A widower coupled to the frame blocker, for windowing each blocked frame *(hamming window multiplier, Fig. 3, Element 215)*; and

Nakatoh and Rahim are analogous art because they are from a similar field of endeavor in mel-frequency enhancement of LP parameters. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the frame windower taught by Rahim with the Mel-LPC feature generation system as taught by Nakatoh to prevent frequency leakage of low frequencies into high frequencies and vice versa, which would cause noise residuals and degrade signal quality. Therefore, it would have been obvious to combine Rahim with Nakatoh for the benefit of obtaining a Mel-LPC feature generator utilizing frame windowing to prevent frequency leakage, to obtain the invention as specified in Claim 7.

With respect to **Claim 8**, Nakatoh teaches the Mel-LPC feature generator as applied to Claim 7. Nakatoh does not teach a low-order pre-emphasis filter, however, Rahim recites:

The speech recognition system, wherein the pre-emphasizer is a fixed low-order digital filter *(first-order pre-emphasis filter, Fig. 3, Element 212, for filter a digitized speech signal, Col. 5, Lines 60-62)*.

Nakatoh and Rahim are analogous art because they are from a similar field of endeavor in mel-frequency enhancement of LP parameters. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the first-order pre-emphasis filter taught by Rahim with the Mel-LPC feature generator taught by Nakatoh in order to provide spectral smoothing to prevent variations in an input speech signal due to noise that could lead to inaccurate LP parameters and further unreliable speech recognition. Therefore, it would have been obvious to combine Rahim with Nakatoh for the benefit of obtaining a Mel-LPC feature

generator featuring a pre-emphasizer to provide necessary speech signal pre-processing in the form of spectral smoothing, to obtain the invention as specified in Claim 8.

With respect to **Claim 9**, Nakatoh teaches the Mel-LPC feature generator as applied to Claim 7. Nakatoh does not teach a Hamming Windower, however, Rahim discloses:

The speech recognition system, wherein the windower is a Hamming window *(Hamming Window Multiplier, Col. 6, Lines 1-3)*.

Nakatoh and Rahim are analogous art because they are from a similar field of endeavor in mel-frequency enhancement of LP parameters. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the Hamming Window Multiplier taught by Rahim with the Mel-LPC feature generator taught by Nakatoh to provide a well-known windowing means (Hamming Window) in order to prevent frequency leakage of low frequencies into high frequencies and vice versa, which would cause noise residuals and degrade signal quality. Thus, it would have been obvious to combine Rahim with Nakatoh for the benefit of obtaining a Mel-LPC feature generator featuring a Hamming Windower to prevent frequency leakage, to obtain the invention as specified in Claim 9.

With respect to **Claim 10**, Nakatoh in view of Rahim teaches the power spectrum generating means implemented in the speech recognition system utilizing Mel-LPC coefficients as applied to Claim 7. Nakatoh in view of Rahim does not specifically disclose modeling a Mel-frequency spectrum utilizing a predetermined number of peaks, however, it would have been obvious to one of ordinary skill in the art, at the time of invention, to model a spectrum using a predetermined number of peaks because a certain number of formants are needed and sufficient to represent peaks and thus provide efficient spectrum representation.

6. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakatoh et al in view of Rahim et al, and in further view of Tran.

With respect to **Claim 11**, Nakatoh in view of Rahim teaches the speech recognition system utilizing Mel-LPC coefficients as applied to Claim 7. Nakatoh also discloses the speech recognizer capable of comparing Mel-LPC features to stored recognition models for word or phoneme recognition, as applied to Claim 1. Neither Nakatoh nor Rahim teach the use of a dynamic time warper in speech recognition, however Tran discloses:

Dynamic time warper for dynamic behavior analysis of said MFLP cepstral coefficients *(speech recognition using a DTW model, Col. 18, Line 61- Col. 19, Line 10, and Fig. 19, Element 232).*

Nakatoh, Rahim, and Tran are analogous art because they are from a similar field of endeavor in speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the speech recognizer utilizing HMMs as taught by Tran with the with the speech recognition system utilizing Mel-LPC coefficients as taught by Nakatoh in view of Rahim to further improve speech recognition accuracy by utilizing DTW models to account for variations in utterance lengths due to different speaker pronunciations. Therefore, it would have been obvious to combine Tran with Nakatoh in view of Rahim for the benefit of obtaining a more robust speech recognition system, utilizing Mel-LPC features, that is compatible with multiple speakers through the use of DTW models, to obtain the invention as specified in Claim 11.

7. **Claim 12** is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakatoh et al in view of Poppert *(U.S. Patent: 6,182,036)*.

With respect to **Claim 12**, Nakatoh teaches the Mel-LPC feature generation system capable of being utilized for speech recognition, as applied to Claim 1. Nakatoh does not specifically teach system implementation in a mobile communication device, however Poppert discloses:

A Mobile communication device comprising :

A flash memory *(flash ROM, Col. 3, Lines 6-10)*;

A microprocessor, coupled to said flash memory *(display processor implemented using a microprocessor, Col. 2, Line 66- Col. 3, Line 6)*,

A DSP processor, coupled to said flash memory and said microprocessor, and responsive to said flash memory and said microprocessor, for performing mel-frequency linear prediction (MFLP) speech recognition *(call processor implemented using a DSP to perform speech recognition, Col. 2, Lines 48-61, using Mel-frequency cepstral coefficients, Col. 3, Line 55- Col. 4, Line 6)*;

A read-only-memory (ROM) device, coupled to said DSP processor, for storage of data *(ROM coupled to the call processor, Col. 2, Lines 52-56)*; and

A random access memory (RAM) device 505, used for data storage *(RAM coupled to the call processor, Col. 2, Lines 52-56)*.

Nakatoh and Poppert are analogous art because they are from a similar field of endeavor in speech recognition. Thus, it would have been obvious to a person of ordinary skill in the art, at the time of invention, to combine the mobile communication device capable of speech

recognition using Mel-frequency cepstral coefficients as taught by Poppert with the Mel-LPC feature generation system capable of being utilized for speech recognition as taught by Nakatoh to increase compatibility of the Mel-LPC feature generation system for speech recognition taught by Nakatoh, through implementation in a common wireless device, to enable enhanced speech recognition in a mobile environment. Also it would have been obvious to one of ordinary skill in the art, at the time of invention, to combine the memories used in the wireless device (RAM, ROM, Flash ROM) in order to be accessed by both processors (DSP and microprocessor) to increase processing efficiency and eliminate additional the physical space that would be required for additional memories. Therefore, it would have been obvious to combine Poppert with Nakatoh for the benefit of obtaining a speech recognition system, utilizing Mel-LPC features, capable of being utilized in a practical wireless device, to obtain the invention as specified in Claim 12.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Hermansky et al (U.S. Patent: 5,165,008)- teaches a means for generating warped LP parameters with a FT utilizing a Bark-scale.
- Beerends et al (U.S. Patent: 5,588,089)- discloses an encoder that applies a DFT, utilizing a Bark-scale, to LP parameters for warping to increase coding efficiency.

- Mokbel et al *(U.S. Patent: 5,864,806)*- teaches a speech recognition system utilizing the transformation of LP parameters using a Mel or Bark scale to provide greater spectrum resolution for low frequencies than for high frequencies.
- Zingher *(U.S. Patent: 6,092,039)*- discloses a speech recognizer that implements a Mel-frequency scale to generate warped LP parameters to account for the non-uniformity of a speech signal.
- Chengalvarayan *(U.S. Patent: 6,292,776)*- teaches a means of generating Mel-LPC coefficients further utilized in speech recognition.
- Laurila et al *(U.S. Patent: 6,691,090)*- discloses a method for the generation and extraction of Mel-frequency cepstral coefficients (MFCCs) for speech recognition capable of generating a FT based on a non-linear mel-frequency scale.
- Kim et al ("A Speech Feature Based on Bark Frequency Warping- The Non-uniform Linear Prediction (NLP) Cepstrum," IEEE Workshop ASP, 1999)- teaches the use of a non-uniform Fourier transform in warping an LP coefficient.
- Bagchi *("The Nonuniform Discrete Fourier Transform and Its Applications in Filter Design: Part I- 1-D," IEEE Transactions CS, 1996)*- teaches the use of a NDFT for added flexibility in selecting sample points to provide variable spectral resolution.
- Okuda et al ("Design of Linear Phase FIR Using the Nonuniform DCT," IEEE, 1998)- discloses a NDCT applied to a least squares approximation on nonuniform frequency grids.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to James S. Wozniak whose telephone number is (703) 305-8669 and email is James.Wozniak@uspto.gov. The examiner can normally be reached on Mondays-Fridays, 8:30-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Talivaldis Ivars Smits can be reached at (703) 306-3011. The fax/phone number for the Technology Center 2600 where this application is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the technology center receptionist whose telephone number is (703) 306-0377.

James S. Wozniak
4/29/04

Talivaldis Smits

TĀLIVALDIS IVARS ŠMITS
PRIMARY EXAMINER